Marissa Renardy

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Employment

Senior Scientist – Mathematical Modeler August 2020 – present
Applied BioMath, Concord, MA.

- Develop, calibrate, and analyze semi-mechanistic PKPD models to support our clients' drug research and development
- Work closely with biologists and project leads to translate biological understanding to mathematical models, and contribute to project team strategy
- Communicate/present results to client teams with varying technical backgrounds
- Support internal research efforts

Postdoctoral Research Fellow May 2018 – February 2021
Department of Microbiology & Immunology, University of Michigan, Ann Arbor, MI.

- Developed and analyzed models of tuberculosis (TB) epidemiology in different settings
- Used optimization and sensitivity analyses to evaluate efficacy of epidemiological interventions
- Applied data analysis techniques to better understand TB imaging data and compare with agent-based model simulations
- Developed expertise in uncertainty quantification, sensitivity analysis, and parameter identifiability

Graduate Teaching Associate July 2013 – May 2018
Department of Mathematics, The Ohio State University, Columbus, OH.

Relevant skills

Mathematical and computational modeling; ordinary differential equations (ODE); partial differential equations (PDE); agent-based modeling; parameter identifiability; sensitivity analysis; parameter estimation; pharmacokinetics (PK); pharmacodynamics (PD); MATLAB; R; some Python experience

Education

Ph.D., Mathematics. The Ohio State University, Columbus, OH. 2013 – 2018
Dissertation: *Parameter analysis in models of yeast cell polarization and stem cell lineage.* Advised by Ching-Shan Chou.

M.S., Mathematics. Virginia Tech, Blacksburg, VA. 2011 – 2013
Thesis: *Analysis of the BiCG Method.* Advised by Eric de Sturler.

B.S., Mathematics. Virginia Tech, Blacksburg, VA. 2008 – 2012

Mentoring

Undergraduates

- Caleb Weissman (University of Michigan, Microbiology major) 2019 – 2020
  Assisted in mentoring Caleb in data analysis techniques applied to TB granulomas.

Peer-reviewed journal articles (reverse chronological order)

1. **Marissa Renardy**, Denise Kirschner, and Marisa Eisenberg. Structural identifiability analysis of age-structured PDE epidemic models. Journal of Mathematical Biology. 2022; 84:9.
2. **Marissa Renardy**, Louis Joslyn, Jess Millar, and Denise Kirschner. To Sobol or not to Sobol? The effects of sampling schemes in systems biology applications. Mathematical Biosciences. 2021; 337:108593.
3. **Marissa Renardy** and Denise Kirschner. Predicting the second wave of COVID-19 in Washtenaw County, MI. Journal of Theoretical Biology. 2020; 507:110461.
4. **Marissa Renardy** and Denise Kirschner. A framework for network-based epidemiological modeling of tuberculosis dynamics using synthetic datasets. Bulletin of Mathematical Biology. 2020; 82(6):78.
5. **Marissa Renardy**, Caitlin Hult, Stephanie Evans, Jennifer Linderman, and Denise Kirschner. Global sensitivity analysis of biological multi-scale models. Current Opinion in Biomedical Engineering. 2019; 11:109–116.
6. **Marissa Renardy**, Timothy Wessler, Silvia Blemker, Jennifer Linderman, Shayn Peirce-Cottler, and Denise Kirschner. Data-driven model validation across dimensions. Bulletin of Mathematical Biology. 2019; 81(6):1853–1866.
7. **Marissa Renardy** and Denise Kirschner. Evaluating vaccination strategies for tuberculosis in endemic and non-endemic settings. Journal of Theoretical Biology. 2019; 469:1–11.
8. Muhammed Emin Ozturk, **Marissa Renardy**, Yukun Li, Gagan Agrawal, and Ching-Shan Chou. A novel approach for handling soft error in conjugate gradients. Proceedings of the 25th International Conference on High Performance Computing (HiPC). IEEE, 2018.
9. Jill Gallaher, Kamila Larripa, **Marissa Renardy**, Blerta Shtylla, Nessy Tania, Diana White, Karen Wood, Li Zhu, Chaitali Passey, Michael Robbins, Natalie Bezman, Suresh Shelat, Hearn Jay Cho, and Helen Moore. Methods for determining key components in a mathematical model for tumor-immune dynamics in multiple myeloma. Journal of Theoretical Biology. 2018; 458:31–46.
10. **Marissa Renardy**, Tau-Mu Yi, Dongbin Xiu, and Ching-Shan Chou. Parameter uncertainty quantification using surrogate models applied to a spatial model of yeast mating polarization. PLoS Computational Biology. 2018; 14(5):e1006181.
11. **Marissa Renardy**, Alexandra Jilkine, Leili Shahriyari, and Ching-Shan Chou. Control of cell fraction and population recovery during tissue regeneration in stem cell lineages. Journal of Theoretical Biology. 2018; 445:33–50.

Book chapters

12. Louis R. Joslyn*, **Marissa Renardy***, Caleb Weissman, Nicole L. Grant, JoAnne L. Flynn, J. Russ Butler, and Denise E. Kirschner (2021). Temporal and spatial analyses of TB granulomas to predict long-term outcomes. In Yoram Vodovotz and Gary An (eds) *Complex Systems and Computational Biology Approaches to Acute Inflammation.* Springer, Cham. (*co-first authors)
13. Jill Gallaher, Kamila Larripa, Urszula Ledzewicz, **Marissa Renardy**, Blerta Shtylla, Nessy Tania, Diana White, Karen Wood, Li Zhu, Chaitali Passey, Michael Robbins, Natalie Bezman, Suresh Shelat, Hearn Jay Cho, and Helen Moore (2018). A Mathematical Model for Tumor–Immune Dynamics in Multiple Myeloma. In: Radunskaya A., Segal R., Shtylla B. (eds) *Understanding Complex Biological Systems with Mathematics.* Association for Women in Mathematics Series, vol 14. Springer, Cham. (peer-reviewed)

Other writing

Pathogen dormancy: origins, mechanisms, and consequences for infection and control. White paper submitted to NSF, 2019.

Grants, honors, and awards

- Landahl Travel Grant (Society for Mathematical Biology) 07/2019
- 1st place, MICDE annual symposium poster competition 04/2019
- Outstanding Graduate/Professional Student Award (OSU Office of Student Life) 03/2018
- Career Development Grant (OSU Council of Graduate Students) 12/2017
- Rhodus Graduate Fellowship (OSU Department of Mathematics) Spring 2017, Spring 2018

Conference presentations

Structural identifiability analysis of PDEs: A case study in continuous age-structured epidemic models. Society for Mathematical Biology Annual Meeting. 06/2021

Predicting the second wave of COVID-19 in Washtenaw County, MI. AMS Special Session on Understanding COVID-19: Mathematical Models to Address the Global Pandemic, I. Joint Mathematics Meetings. Online. 01/2021

Predicting the second wave of COVID-19 in Washtenaw County, MI. Poster. MIDAS Annual Symposium. Online. 11/2020

A data analytic approach to classifying TB granulomas. Minisymposium: Mathematical modeling of immune cells in disease progression. SIAM Life Sciences Meeting. Online. 06/2020

Temporal and spatial analyses of TB granulomas to predict long-term outcomes. Contributed talk. Mathematical and Computational Methods in Biology, Mathematical Biosciences Institute, Columbus, OH. 05/2020

MAA Panel: So You're (Going to Be) a Postdoc: Now What? A Panel Discussion on a Fulfilling Postdoc Experience. Panelist. Joint Mathematics Meetings (JMM), Denver, CO. 01/2020

Structural parameter identifiability in age-structured epidemic models. Contributed talk. Joint Mathematics Meetings (JMM), Denver, CO. 01/2020

Navigating biological research as an early-career mathematician. Invited talk. APS Conference on the Interface of Mathematical Models and Experimental Physiology: Organ Function from the Microvascular Perspective, Scottsdale, AZ. 09/2019

Evaluating vaccination strategies for tuberculosis in endemic and non-endemic settings. Contributed talk. Society for Mathematical Biology (SMB), Montréal, Canada. 07/2019

Evaluating vaccination strategies for tuberculosis in endemic and non-endemic settings. Special session: Mathematical biology. SIAM Great Lakes Sectional Meeting, Ann Arbor, MI. 04/2019

Evaluating vaccination strategies for tuberculosis in endemic and non-endemic settings. Poster. MICDE Symposium, Ann Arbor, MI. [This poster won 1st place in the poster competition.] 04/2019

Modeling tumor immune dynamics in multiple myeloma. Contributed talk. AWM Research Symposium, Houston, TX. 04/2019

Modeling tumor immune dynamics in multiple myeloma. AMS Special Session on Recent Advancements in Mathematical Modeling of Cancer, I. Joint Mathematics Meetings (JMM), Baltimore, MD. 01/2019

Evaluating vaccination strategies for tuberculosis in endemic and non-endemic settings. Contributed talk. Joint Mathematics Meetings (JMM), Baltimore, MD. 01/2019

Control of cell fraction and population recovery during tissue regeneration in stem cell lineages. Minisymposium: Multiscale Modeling and Simulation of Biological Systems. SIAM Life Sciences Meeting, Minnesota, MN. 08/2018

Modeling tumor immune dynamics in multiple myeloma. Minisymposium: Women Advancing Mathematical Biology - Understanding Complex Biological Systems with Mathematics. SIAM Annual Meeting, Portland, OR. 07/2018

Parameter uncertainty quantification using surrogate models applied to a spatial model of yeast mating polarization. Special Session on Parameter Analysis and Estimation in Applied Dynamical Systems, I . AMS Spring Central Sectional Meeting, Columbus, OH. 03/2018

Parameter uncertainty quantification for a spatial model of cell polarization. Poster. Symposium on Multi-scale Bioimaging in Systems Biology, Ann Arbor, MI. 01/2018

A method for sensitivity analysis and parameter estimation applied to a large reaction-diffusion model of cell polarization. Contributed talk. Joint Mathematics Meetings (JMM), San Diego, CA. 01/2018

A method for sensitivity analysis and parameter estimation applied to a large reaction-diffusion model of cell polarization. Minisymposium: Models of biological patterning in developing and adult organisms. 10th International Symposium on Biomathematics and Ecology Education and Research (BEER), Normal, IL. 10/2017

A reaction-diffusion model of cell polarization in yeast. Poster. SIAM Annual Meeting, AWM Workshop, Pittsburgh, PA. 07/2017

A reaction-diffusion model of cell polarization in yeast. Poster. Biology and Medicine through Mathematics (BAMM!), Richmond, VA. 05/2017

Stem cell lineages: Control of cell fraction and population recovery. Contributed talk [last minute entry, not on program]. 5th International Conference on Computational and Mathematical Biomedical Engineering (CMBE), Pittsburgh, PA. 04/2017

A reaction-diffusion model of cell polarization in yeast. Poster. 5th Annual Midwest Women in Mathematics Symposium (WIMS), Indianapolis, IN. 02/2017

Choosing a mathematics graduate program. Invited panelist. 19th Nebraska Conference for Undergraduate Women in Mathematics (NCUWM), Lincoln, NE. 02/2017

Departmental talks and guest lectures

Agent-based modeling in epidemiology. Keynote speaker, Clarkson University mini-conference on applications of agent-based modeling to biological systems. 10/22/2021

Mathematical and computational modeling as tools for tuberculosis elimination. Systems Medicine Seminar, University of Florida. Online. 07/01/2021

Structural identifiability analysis of PDEs: A case study in continuous age-structured epidemic models. PDE and Applied Math Seminar, University of California, Riverside. Online. 02/10/2021
Predicting the second wave of COVID-19 in Washtenaw County, MI. CSCS/MIDAS/MICDE Seminar, University of Michigan. Online. 10/20/2020
Modeling the COVID-19 pandemic, co-presented with Wasiur KhudaBukhsh. Invited lecture, The Erdös Institute. Online. 05/28/2020
Mathematical and computational modeling as tools for tuberculosis elimination. Applied math seminar, The Ohio State University, Columbus, OH. 02/20/2020
Parameter analysis in yeast cell polarization and stem cell lineages. Invited lecture, Kirschner Lab, University of Michigan, Ann Arbor, MI. 02/01/2018
Parameter analysis in yeast cell polarization and stem cell lineages. Biomath seminar series, North Carolina State University, Raleigh, NC. 01/26/2018
Parameter estimation for a large model of yeast cell polarization. Science lecture series, Ohio Wesleyan University, Delaware, OH. 11/09/2017
*A method for parameter sensitivity analysis and parameter estimation using polynomial surrogates*Math graduate student seminar, The Ohio State University, Columbus, OH. 10/24/2017
A reaction-diffusion model of cell polarization in budding yeast. Math graduate student seminar, The Ohio State University, Columbus, OH. 04/19/2016

Workshop participation

AMS Mathematical Research Community, *Dynamics of Infectious Diseases: Ecological Models Across Multiple Scales.* 2020 – 2021
STEM Faculty Launch. Worcester Polytechnic Institute, Worcester, MA. 10/2019
Summit on the Rules of Life. Mathematical Biosciences Institute, Columbus, OH. 06/2019
Women Advancing Mathematical Biology: Understanding Complex Biological Systems with Mathematics. Mathematical Biosciences Institute, Columbus, OH. 04/2017

Professional service

Departmental/Institutional

- Panelist, Industry career panel. University of Southern California Women in Science and Engineering (USC WiSE). 04/2021
- Guest lecturer, Michigan Math & Science Scholars (MMSS) Program 06/2020
- Invitations to Industry seminar, Erdös institute
  - Organizer at U of M Department of Mathematics 2019 – 2020
  - Graduate student organizer at OSU Department of Mathematics 2018
- Organizer, 2018 OSU Math Grad DataFest
- Association for Women in Mathematics Student Chapter at The Ohio State University
  - President 2015 – 2018
  - Founder 2015
- OSU Math Graduate Student Association
  - Member 2015 – 2018
  - Travel fund committee member 2017 – 2018
- Judge, 2017 OSU Mathematical Modeling Contest

- Student representative, Graduate Studies Committee, OSU Math Department 2015 – 2016

National/International

- Co-Chair of Membership, Society for Mathematical Biology 2019 – 2020
- Organizing Committee, Society for Mathematical Biology 2020 Annual Meeting 08/2020
- Minisymposium co-organizer, Society for Mathematical Biology 2021 Annual Meeting (online). *The pressing need for within-host computational models of the pulmonary immune response.* 06/2021
- Minisymposium co-organizer, ENAR 2021 (online). *Stochastic, network-based approaches to mechanistic modeling in epidemiology.* 03/2021
- Minisymposium co-organizer, Society for Mathematical Biology 2019 Annual Meeting, Montréal, Canada. *Individual- and agent-based models of within-host disease dynamics.* 07/2019
- NSF-related service
  - Organized a working group at MBI on the Rules of Life that resulted in a white paper submitted to NSF. 2019
  - Grant review panel (Mathematical Biology Program of DMS) 2018
- Reviewer for the following journals:
  - Journal of Theoretical Biology
  - Frontiers in Systems Biology
  - PLoS ONE
  - Mathematical Biosciences and Engineering
  - Mathematical Medicine and Biology
  - Letters in Biomathematics
  - Heliyon

Professional affiliations

- International Society of Pharmacometrics (ISoP)
- Association for Women in Mathematics (AWM)
- Society for Mathematical Biology (SMB)
- Society for Industrial and Applied Mathematics (SIAM)